Forman Christian College (A Chartered University)

Department of Chemistry

Course Information

Course Title	INTRODUCTION TO INORGANIC CHEMISTRY
Course Code	CHEM 150 A
Course Instructor	Dr. Mariya al-Rashida; Room No. S103
Semester	SP 2023
Credit	3 + 1
Notes & Handouts and latest researches according to the topic will be given.	

COURSE REQUIREMENTS

Students are expected to attend every class and to arrive on time. Attendance less than 80% may lead to negative effect on grade. Students can consult the instructor during office hours for any difficulty related to the course.

There is no making up for quizzes, while make up for mid term exam is possible for only under extreme cases. Along with theory, practical classes are mandatory, a student will not be allowed to take practical exam if he/she was absent during practicals/lab. Some of the course topics may be covered during practical classes.

Course Outline

Core Concept	Topics
Periodic Table, Structure of Atom and Electronic Configuration	1. Classification of elements in The Periodic Table 2. Atomic structure (classical and quantum model) and electronic configuration 3. Aufbau Principle, Hund's Rule, Pauli's Exclusion Principle 4. Noble Gas Notation and Box Notation for electronic configuration 5. Quantum Numbers
Types of Chemical Bonding	1. Ionic Bond, Covalent Bond, Coordinate Covalent Bond 2. Electron Deficient Compounds (BF3), 3 Center 2 Electron Bonds
Theories of Chemical Bonding	1. Valence Shell Electron Pair Repulsion Theory (VSEPR) 2. Valence Bond Theory and hybridization (sp, sp^2, sp^3, sp^3d, sp^3d^2 and d^2sp^3) 3. Brief introduction to Coordination chemistry and Werner's Theory 4. Crystal Field Theory (CFT), splitting of d orbitals in octahedral and tetrahedral fields. 5. Molecular Orbital Theory, MO diagrams for homonuclear diatomic molecules from First and Second rows of the Periodic Table. heteronuclear diatomic molecules CO, NO, HX (X = halogen).

Student Learning Objectives

1. To understand the basic concept and nature of different types of chemical bonding.
2. To be familiar with basic theories of chemical bonding.
3. To be able to predict geometries of molecules based on VSEPR theory.
4. To be able to apply principles of different chemical bonding theories to different molecules.

5. To apply acquired knowledge to describe hybridization of atoms in different molecules.

Detailed Lecture Plan

Topic	Activities and Assignments
Electronic configuration of atoms and ions, Nature and principle of chemical bonding, types of chemical bonds ionic, covalent, coordinate covalent, sigma and pi bonds, Valence shell electron pair repulsion (VSEPR) theory, Basic idea and predicting shapes of molecules.	
VSEPR continued, applications of VSEPR theory and its limitations, prediction of shapes of molecules with the help of VSEPR theory,	
Valence Bond Theory (VBT) basic principle and concept of orbital hybridization	
Detailed description of sp3, sp2, sp, orbital hybridizations with molecular examples	Assignment 1 Announced
Detailed description of sp3d2 and sp3d3 orbital hybridizations with molecular examples, advantages and disadvantages of VBT	Quiz 1
Bonding in electron deficient molecules, 3-center two electron bonds, bonding in diborane	**Mid Term Exam**
Molecular Orbital Theory (MOT), basic theory and principle and concept, bonding and antibonding molecular orbitals, MOT of homonuclear diatomic molecules	Assignment 1 Submission
Application of MOT to heteronuclear diatomic molecules, advantages and disadvantages of MOT	Assignment 2 Announced
VBT of metal complexes, inner and outer orbital complexes, High and low spin complexes,	Quiz 2
Application of VBT to explain bonding in octahedral complexes	Assignment 2 Submission
Application of VBT to explain bonding in tetrahedral and square planar complexes	Quiz 3

Crystal field theory (CFT) basic introduction and concept of splitting of d-orbitals, CFT in octahedral field with examples of octahedral complexes	**Lab Exam**
Application of CFT in tetrahedral field with examples of tetrahedral complexes	Last Day of Classes

Recommended Text Book

1. Chemistry and Chemical reactivity by John C. Kotz and Paul M. Treichel, Jr., 5th Ed., Thomson Books/Cole, USA.

Books for Further Reading

- Chemistry: A Molecular Approach by Nivaldo J. Tro, 4th Ed., 2017, Pearson Education Limited, UK.
- Chemistry, The Central Science by Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodward, Matthew W. Stoltzfus, 14th Ed., 2018, Pearson Education Limited, UK.
- Chemistry and Chemical Reactivity by John C. Kotz, Paul M. Treichel and John R. Townsend, 7th Ed, 2010, Brooks/Cole, Cengage Learning, USA.

Practical List

Solution Making

1. Making solutions of different concentrations
2. Making dilutions from stock solution

Volumetric Analysis

3. Standardization of given solution of NaOH using 0.1 M standard solution of HCl.
4. Find out percentage purity of a given mixture of KOH and KCl using 0.1 M standard solution of HCl.
5. Standardization of given solution of baking soda (Na_2CO_3) using 0.1 M standard solution of HCl.
6. Find out percentage purity of baking soda.
7. Standardization of given solution of $FeSO_4$ using 0.02 M standard solution of $KMnO_4$.
8. Standardization of given solution of Mohr's salt using 0.02 M standard solution of $KMnO_4$.
9. Find out percentage impurity of Mohr's salt using 0.02 M standard solution of $KMnO_4$.

Titration using pH Meter

10. Find out amount in g/L of a given solution of NaOH using pH meter.

Assessment Policy

1. **Tests and Examinations:** During each semester the student will take the following tests and examinations.

   (a) Quizzes: A minimum of 4 quizzes will be conducted throughout the semester **There will be no makeup quizzes for any type of absentees**.

   (b) Midterm Exam: The midterm exam will be conducted within the ongoing semester. The paper will be of 30-35 marks. Marked papers will be shared with the students. **There will be no makeup midterm for any type of absentees except in case of genuine a reason whereby prior approval is required from the course instructor.**

   (c) Final Examination: The final examination will be held at the end of the semester. The paper will be of 35-40 marks. The final term exam will be conducted from complete syllabus and at least one third of the paper content will comprise from the syllabus covered before midterm.

   (d) Paper Pattern: The mid and final term examination will consist of short questions and answers.

2. **Course Evaluation**

Quizzes	:	10%
Assignments	:	5%
Mid Term	:	20%
Final Term	:	35%
Practical Exam	:	25%
Class participation	:	5%

3. M**inimum Attendance Requirement:** Students are expected to attend all the classes to take full advantage of the learning opportunities including quizzes, tests, home assignments, projects and presentations. A minimum of 80 percent class attendance is mandatory to sit in the final examination of every semester. No allowance whatsoever shall be given on this account.

Teaching Methodologies

Following teaching methodologies will be adopted for teaching this course;

1) Lecture Method
2) Discussion Method
3) Demonstration Method
4) Question Answer Method
5) Project/Assignment Method
6) Inductive/Deductive Method

Activities

Students will be encouraged to engage themselves in the following activities to enhance the understanding of this course and to appreciate team work, self-grooming and individual confidence;

1) Group Activities
2) Individual Activities
3) Pair Work
4) Home Assignment
5) Project
6) Presentation
7) Classroom Discussions